MATH 100 – WORKSHEET 10
LOGARITHMS AND THEIR DERIVATIVES

1. Inverse Trig & Differentiation

Fact. $\frac{\mathrm{d}\arcsin x}{\mathrm{d}x} = \frac{1}{\sqrt{1-x^2}}$, $\frac{\mathrm{d}\arctan x}{\mathrm{d}x} = \frac{1}{1+x^2}$.

(1) The angle θ lies in the range $-\frac{\pi}{2} \le \theta \le \frac{\pi}{2}$ and satisfies $\sin(\theta) = 0.4$. find $\tan\theta$.

(2) (Final 2011) Find the derivative of $\arcsin(3x+1)$

2. Review of Logarithms

$$\boxed{\log_b(b^x) = b^{\log_b x} = x}$$

$$\boxed{\log_b(xy) = \log_b x + \log_b y} \qquad \boxed{\log_b(x^y) = y\log_b x} \qquad \boxed{\log_b \frac{1}{x} = -\log_b x}$$

(1) $\log\left(e^{10}\right) =$ $\log(2^{100}) =$ (in terms of $\log 2$)

(2) A variant on *Moore's Law* states that computing power doubles every 18 months. Suppose computers today can do N_0 operations per second.

(a) Write a formula for the power of computers t years into the future:

- Computers t years from now will be able to do $N(t)$ operations per second where

$$N(t) =$$

(b) A computing task would take 10 years for today's computers. Suppose we wait 3 years and then start the computation. When will we have the answer?

(c) At what time will computers be powerful enough to complete the task in 6 months?

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3. Differentiation

$$\boxed{(\log x)' = \frac{1}{x}} \qquad \boxed{f' = f \times (\log f)'}$$

(1) Differentiate

(a) $\frac{\mathrm{d}(\log(ax))}{\mathrm{d}x} =$ $\qquad$ $\frac{\mathrm{d}}{\mathrm{d}t} \log\left(t^2 + 3t\right) =$

(b) $\frac{\mathrm{d}}{\mathrm{d}x} x^2 \log(1 + x^2) =$ $\qquad$ $\frac{\mathrm{d}}{\mathrm{d}r} \frac{1}{\log(2+\sin r)} =$

(c) Find y' if $\log(x + y) = e^y$